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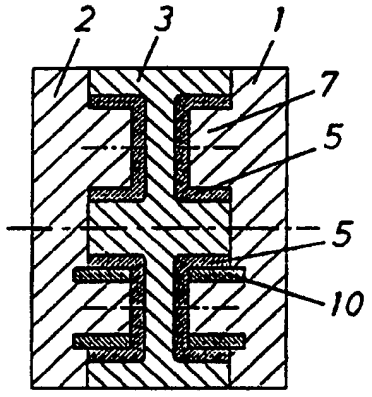
(57) Abstract

The invention concerns a procedure for the moulding of an assembled object and a machine for the performance of the procedure. The in at least two subsequent mouldings manufactured object is moulded in a mould comprising at least three mould parts. In each of the at least two in the closed mould formed set of mould cavities (6) is, when the mould is open, at least one of the mould parts (3) or a part hereof (3') turnable e.g. 180 degrees around an axis (4) or axle (4'), which is parallel to the mutual direction of movement of the mould part in relation to the opposing mould part. In a mould consisting of three mould parts can e.g. the middle part (3) be turnable in relation to the two outermost mould parts (1 and 2).



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PROCEDURE AND MACHINE FOR MULTI COMPONENT MOULDING

The invention concerns a procedure for the production of an in at least two subsequent mouldings moulded object in a mould consisting of at least three mould parts and a machine for the performance of this procedure.

It is a known technique to mould an assembled object in two or more subsequent mouldings, e.g. an injection moulded object in plastic in two different colours moulded subsequently in the same mould. This can be realized by the material of one colour is moulded at first in one part of a for this purpose arranged mould, e. g. a letter in a key for an injection moulded keyboard. After the cooling of the material and removing of the core parts, the material of the second colour is then moulded around the moulded letter, which now serves as a part of the mould for the finished key. This procedure requires an injection moulding machine with two injection units.

Such a two component moulding can preferably be realized in a so-called index mould. This is a mould where one of the two mould parts, either the stationary front part with the injection unit or the movable back part with the ejection unit, is equipped with a build-in turning table. The turning table can preferably turn 180 degrees around an axis passing through the centre of the turning table and parallel to the mutual direction of movement of the two mould parts.

Hereby is achieved that the first part of the for the co-moulding intended object e. g. can be moulded in those of the closed mould formed mould cavities which are placed in the upper half of the mould. After the opening of the mould, turning of the turning table 180 degrees and reclosing of the mould, the last part of the object subsequently can be moulded in the mould cavities, which qua the first moulding is formed in the lower half of the mould.

There are also known moulds that beyond the two common mould parts, the stationary front part and the movable back part, comprises a third mould part. This is the case in the so-called three plate tools. Here the inlet channels in the mould e.g. are placed between the two foremost mould parts and the objects between the two hindmost mould parts. Hereby is achieved that the objects and the inlets are torn off and ejected separately when the mould is opened after each moulding cycle. The advantage of such a mould is that the inlets and the finished objects hereby can be kept separated more easily and you can save the expensive hot-runner systems.

There are also known another kind of moulds consisting of more than two mould parts, the so-called sandwich moulds/stack moulds. In its most simple design a sandwich mould consists of three mould parts as there beside the front part and the back part is a middle part. In reality you hereby obtain two side by side placed independent moulds which open and close simultaneously by means of an on the outside of the mould placed

frame system. This frame system connects e. g. via a knee hinged joint system the middle part, whereto the frame system is firmly attached, with the two outermost mould parts.

The advantage of such a sandwich mould is that there in principle are moulded twice as many objects per time unit compared to a common mould consisting of two mould parts.

There are also known sandwich moulds with a larger number of mould parts, e. g. five. Hereby is in reality achieved four independent moulds which open and close simultaneously by means of the on the outside of the mould placed frame system which also here is attached to the middle mould part.

The purpose of the procedure and the machine according to the invention is to unite the advantage of the highly increased number of objects per time unit from the sandwich mould with the suitability of the index mould especially for the moulding of objects moulded in at least two subsequent mouldings in the same mould. An extra advantage is that you can achieve the balance in the mould by popular speaking to mould "upwards" in the one part at the same time as you mould "downwards" in the other part. This results that the mould is stressed uniformly during the moulding process in contrast to a common index mould where the pressure primarily is not centred. A further explanation on this is given beneath under fig. 4.

The procedure according to the invention is characterized by the fact, that in each of the at least two in the closed mould formed pair of cavities is, when the mould is open, at least one of the two mould parts or parts hereof turnable in relation to the opposite mould part, e. g. 180 degrees around an axis which is parallel to the mutual direction of movement of the mould parts.

The principle in the procedure according to the invention can in its simplest form be described in the case with three mould parts, where the middle part alone contains a turnable element. For each moulding cycle is presumed that in each of the two hereby achieved moulds is moulded a single object comprising two parts, e. g. a screw cap of plastic and the matching threaded tube neck, intended for the placement on a pill jar. The screw cap preferably is moulded at first, e. g. in the upper half of the mould. After cooling and opening of the mould the middle part is turned half a round, hereafter the mould is reclosed. With the inside of the screw cap serving as a part of the mould the corresponding threaded tube neck is moulded. Simultaneous with the final moulding of the first set of the assembled objects in the now downwards placed part of the mould, is in the upper half of the mould moulded the next set of screw caps, and so the process is continued.

The cycle described above is for two similar objects moulded assembled and ejected together per cycle. In principle the

case is the same for a larger number of mould cavities in the mould, as well as if the mould consists of more than three co-operating mould parts.

The procedure according to the invention can hereby achieve a considerable saving in both time and costs by the moulding of objects consisting of two or more components compared to the hitherto known methods for subsequent moulding.

By the design of the mould tool you will have to consider that the first moulded parts of the objects after cooling and opening of the mould remains in/on the turnable mould part(s). Hereby at the turning they will e.g. be moved from the upper half of the mould to the lower half. The simplest way to obtain this is by a better hold-down in the turnable mould part(s) than in the not turnable.

In a special suitable design of the machine for the performing of the procedure according to the invention there is a preferably through the common axis of all the turnable parts running axle. This axle can turn the turnable parts which preferably are situated in every second of the mould parts while the axle can pass through the other mould parts, the so-called stationary mould parts, without activating those.

The more specific advantages by the different designs of the invention will be disclosed in the description to the drawing and by the actual drawing, where

fig. 1 shows a design according to the invention in a closed position,

fig. 2 the same in an open position,

fig. 3 the same in an open position with the middle part turned,

fig. 4 the same in a closed position,

fig. 5 the same in an open position by the ejection of the finished objects,

fig. 6 the same after a new turning in an open position,

fig. 7 another design in an open position,

fig. 8 a third design in an open position.

In fig. 1 is shown in closed condition from the side a cross section of an example of a mould for the performance of the procedure according to the invention. The mould consists of a stationary front part 1, a movable back part 2, as well as a herby simultaneous movable middle part 3, that also is intended to be turned around a here horizontal axis 4. In the

example there has just been moulded as the first part 5 of the assembled object a screw cap in the two above the axis 4 formed mould cavities 6. On respectively the front part 1 and the back part 2 is shown the large cores 7 at the top for the first moulding and the somewhat smaller cores 8 for the following moulding. In the middle part 3 is shown the symmetrical placed and identical cavities 9 that together with the large cores 7 form the mould cavities 6.

Fig. 2 shows a cross section of the same mould in an open position, where the two first parts of the assembled objects 5 are moulded and positioned in the cavities 9 in the middle part 3.

In fig. 3 is shown the same mould still fully opened, but where the middle part 3 is turned 180 degrees around the horizontal axis 4, so that the two first moulded parts 5 now are positioned precisely facing the smallest cores 8 in the two not turnable mould parts 1 and 2.

In fig. 4 is shown the same mould after reclosing. There are on the mould parts some not shown guide pins and corresponding holes which by the closing steer the mould parts precisely together after the turning. It will be noticed that the mould during the whole process is symmetrical around a plane at right angles to the plane of the paper and right down through the centre line of the middle part 3. This causes that the closing pressure are distributed relative uniformly on the two sets of mould cavities, respective the right and the left set. To obtain an even better distribution of the moulding process over the total surface area the mould cavities and the corresponding cores can be placed so they are symmetrical placed in relation to the centre of the middle part. Hereby is moulded the first part 5 at the same time, e. g. above in the right mould and beneath in the left mould, and the following part 10 at the same time corresponding beneath in the right mould and above in the left mould. Hereby obtaining the most complete balance throughout the whole moulding process which strain the mould least possible. The last mentioned possibility is not shown on the drawing. In fig. 4 is further shown that there inside the first moulded part 5, the screw cap, which now serves as a part of the mould, now is moulded the last part 10, the threaded tube neck, of the assembled object. The outer threading of this has after the cooling shrunk a bit, so it fits well into the inner threading of the screw cap, of which it is a print.

Fig. 5 shows the same mould in an open position during the ejection of the two final moulded objects.

In fig. 6 the same mould is shown where the middle part 3 again is turned 180 degrees around the axis 4. It will be noticed that fig. 6 corresponds to fig. 3, and like this the process can continue. Alternatively to the various turnings

have been at 180 degrees there could also have been shown turnings on 120 degrees, 90 degrees or another specified graduation, which makes respectively a three component, a four component moulding etc. possible. The increased number of graduations can e.g. also be used for extra cooling stations, if for example some of the mouldings need a longer cooling time than others as well as moulding in a closed mould etc..

Fig. 7 shows in perspective another design of a mould with three parts. Here the middle part 3 is parted in a turnable part 3' and a not-turnable part 3'', where the turnable part 3' is positioned by means of a not on the drawing shown ball bearing or the like, which eases the turning because the pate/plates are not stressed on their respective closing area during the turning. The turning axis 4, which here is a real turning axle 4', is designed in such a way that it can pass through the two not-turnable mould parts 1 and 2 while it activates the turnable part 3' of the middle part 3.

In fig. 8 in perspective a third design is shown of a mould according to the invention with five mould parts resulting in four separate moulds, here shown in an open position. In the example shown there are 30 plus 30 cavities in each of these moulds, so that per completed cycle a total of 120 assembled objects are ejected.

The in the drawing shown designs of the machine according to the invention are only a limited part of the possible examples of designs. Yet they should be sufficient for showing the fundamental principles of the invention.

Beside the on the drawing shown a special ejecting system could have been shown, preferably for the placement in the turnable middle part, consisting of three plates. Of these the two outermost can be movable in relation to the middle, whereby they can serve as a stripper plate and/or make space for an inlet system.

Claims:

1. Procedure for the production of an in at least two subsequent mouldings moulded object in a mould consisting of at least three mould parts, characterized by the fact, that in each of the at least two in the closed mould formed set of mould cavities (6) is, when the mould is open, at least one mould-part or parts hereof turnable, e.g. 180 degrees around an axis (4) parallel to the mutual movement direction of the mould parts in relation to the opposing mould part.

all dependent

2. Procedure as mentioned in claim 1, characterized by the fact that it is the two outermost placed mould parts (1 and 2) which both are turnable around an axis (4), which is parallel to the mutual movement direction of the mould parts, while the middle mould part (3) not need to be turnable.

3. Procedure as mentioned in claim 1, characterized by the fact that it is the middle mould part (3), or parts hereof (3'), which is turnable around an axis (4), which is parallel to the mutual direction of movement of the mould parts, while the two outermost mould parts (1 and 2) not need to be turnable.

4. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that preferably through the centre of all the mould plates runs a turnable axis (4'), which can turn all the turnable parts of the mould parts, preferably every second of the mould parts, by the axis being engaged with the turnable parts and where the axis just can pass through the remaining, the so-called solid mould parts, without activating these.

5. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that the single mould parts of the mould are controlled by a frame system, e. g. by means of some sort of knee hinge, which causes that all the mould parts are moving uniformly in relation to each other in the progressing movement during both the opening and the closing.

6. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that the turnable mould part(s) (3, 3') are placed preferably in a solid mould plate (3'') where an inner preferably circular part (3') is placed in some sort of bearing, which causes the turnable part (3') of the turnable mould part(s) to be fastened through the outermost part (3'') of its perphery in some sort of rail in the solid mould plate in question.

7. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that the turnable part (3'), which preferably is placed in a not-turnable mould plate

(3''), is placed independently on the axis (4'), yet turnable by this.

8. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that the turnable part (3') of a mould part (3) is placed in and fixed to e.g. the inner ring of a large ball bearing, while the not-turnable part (3'') of the mould part is fixed around the outermost ring of the ball bearing.

9. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that when there during the sequential course is moulded in the mould, there is moulded crosswise to obtain balance in the mould, which means that e.g. in the right set of cavities are moulded the first parts (5) at the top, while the corresponding set of first parts (5) in the left set of cavities are moulded opposite, here at the bottom, and the same procedure is the case with the following moulding (10), which therefore here will be at the bottom in the right set of mould cavities and at the top in the left set of mould cavities.

10. Procedure/machine as in at least one of the previous claims mentioned, characterized by the fact, that the turnable middle part (3) is constructed of at least three plates, from which the two outermost are movable in relation to the middle one, which makes it possible for them to function as tear off plates and/or inlet system.

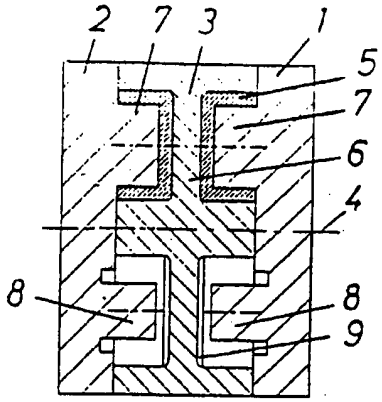

FIG. 1

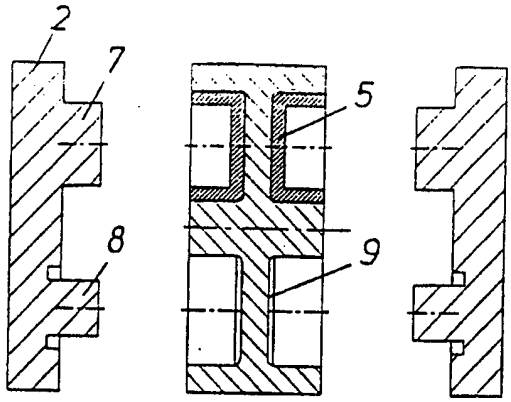

FIG. 2

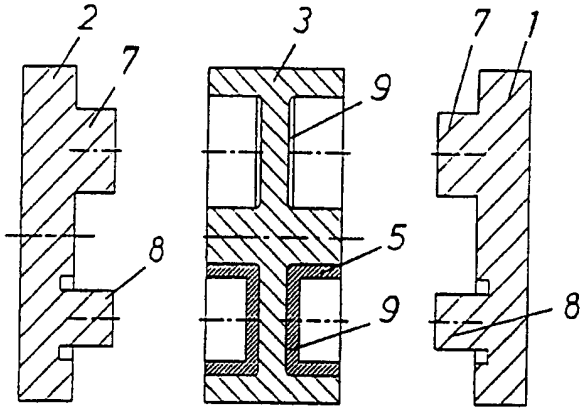

FIG. 3

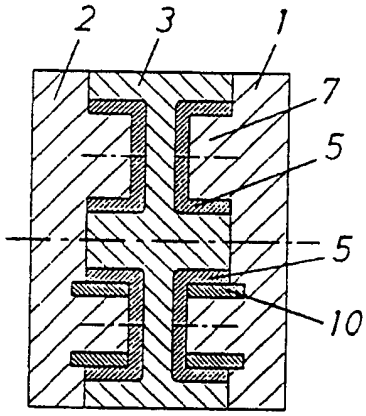

FIG. 4

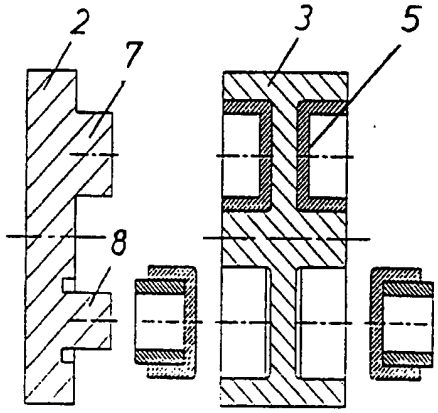

FIG. 5

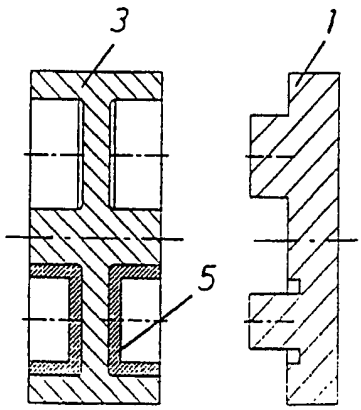

FIG. 6

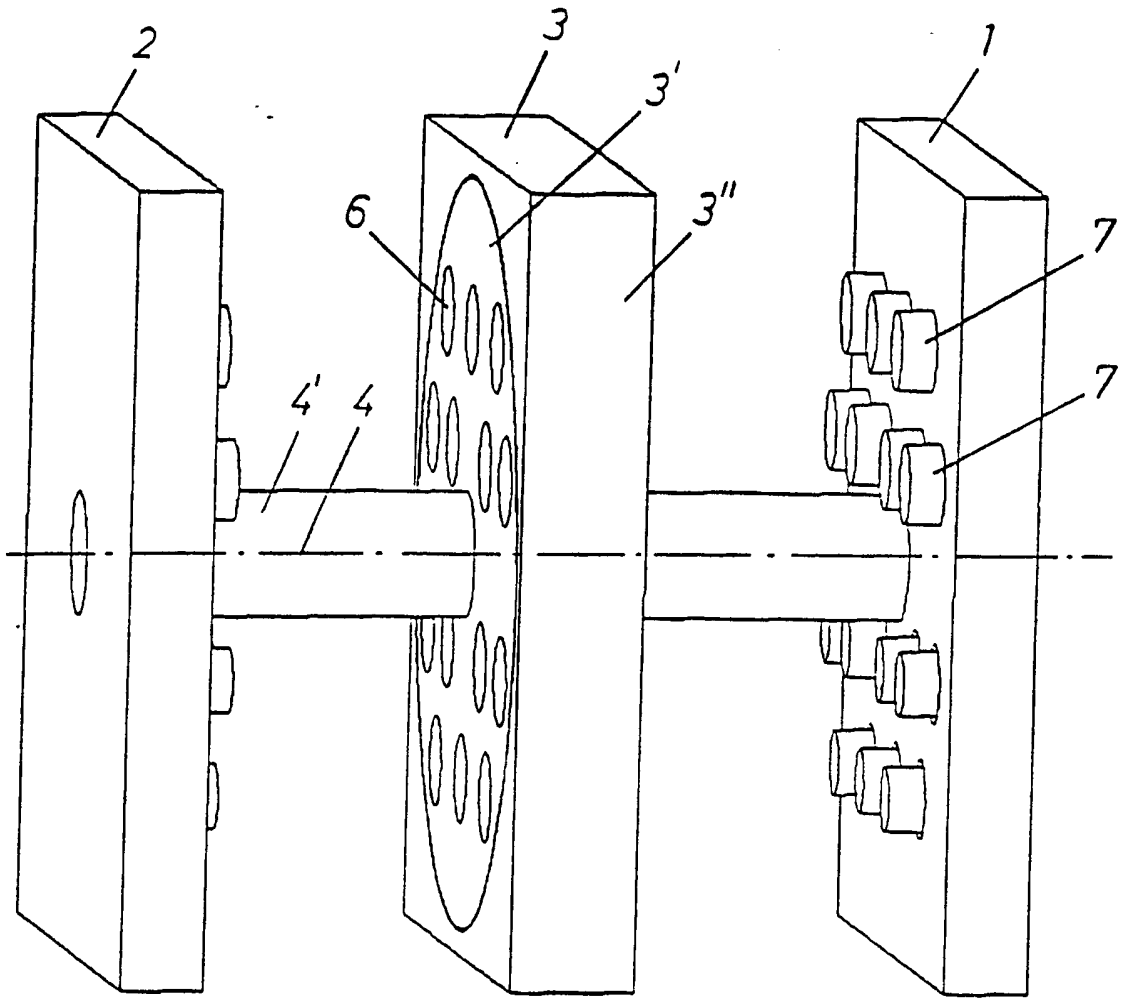

FIG. 7

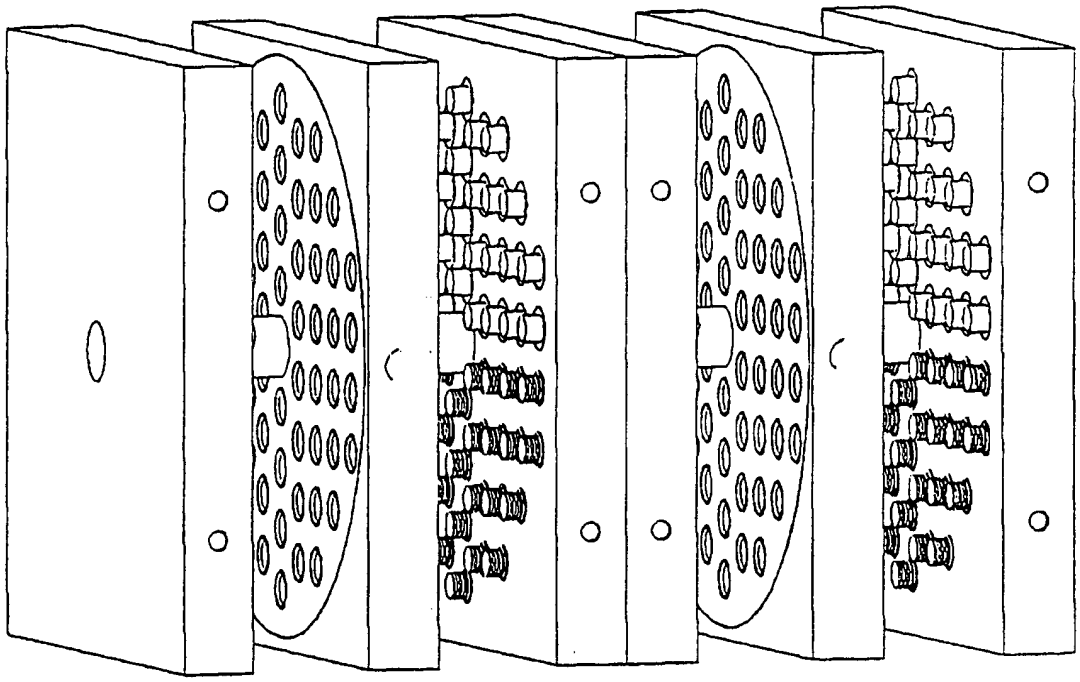

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 98/00072

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B29C 45/06, B29C 45/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 3832110 A (KARL HEHL), 27 August 1974 (27.08.74), column 3, line 57 - line 63; column 6, line 26 - line 47, figures 1,10-12, abstract --	1,3,5
X	Patent Abstracts of Japan, abstract of JP 11-10918 A (OOSHITA SANGYO KK), 27 April 1989 (27.04.89), figure 6, abstract --	1
A	US 4589840 A (ROBERT D. SCHAD), 20 May 1986 (20.05.86), figures 1-2, abstract --	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

09/06/98

International application No.
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